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NF02-504 Atrazine and Non-Atrazine Herbicide Comparisons in No-Till Corn

Fred Roeth
University of Nebraska - Lincoln, fwroeth41@gmail.com

Alex Martin
University of Nebraska - Lincoln, amartin2@unl.edu

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Atrazine and Non-Atrazine Herbicide Comparisons in No-Till Corn

By Fred Roeth. Extension Weed Specialist, South Central Research and Extension Center
Alex Martin, Extension Weed Specialist, Agronomy and Horticulture Department

Summary: *Although not all herbicides were completely effective in this study, various ones performed well, including atrazine and non-atrazine treatments. The atrazine treatments cost less than most other treatments. The sequential application strategy was consistently better than a single application because the postemergence followup treatment controlled the escapes and second flushes. Single treatments were at a disadvantage in that regard; however, several preemergence, non-atrazine herbicide treatments were noteworthy in their performance.*

Atrazine herbicide has been in an EPA special review since 1994 because of soil surface runoff concerns. Applied to 85 percent of the corn acres in the United States, atrazine is a versatile herbicide used in preplant, preemergence, or early postemergence treatments. Most atrazine is used in combination with other herbicides to broaden the weed control spectrum and to reduce atrazine carryover concerns.

Beginning in 1997, we evaluated atrazine and non-atrazine herbicide treatments in conventional tillage corn (1997 and 1998) and no-till corn (1999 and 2000) on university research farms at Clay Center (irrigated) and Lincoln, Nebraska (non-irrigated). The objective was to compare some common atrazine and non-atrazine herbicides in soil-applied and postemergence treatment combinations. Fourteen herbicide treatments were selected to represent commonly used herbicide classes and application timings *(Table II)*. This NebFACT reports the no-till results. (See NF02-503 for the conventional till results.)

Results

Overall weed control exceeded 90 percent in 5 of 14 treatments and was less than 75 percent in only one treatment *(Figure 1)*. Overall weed control represents total effectiveness of the treatment across weed species present in the test. These weeds were yellow and green foxtails, velvetleaf, and sunflower (sunflower only at Lincoln). A score above 90 indicates that all weed species were satisfactorily controlled. Each herbicide treatment was given a combined score for crop safety and yield protection *(Figure 2)*. Treatments were scored on a 0 to 100 scale for crop injury, corn height, and corn yield compared to the weed-free checks. Treatments that were postemergence only did not score well on crop protection because weeds allowed to grow with the corn for several weeks reduced corn height and corn yield, especially in the Lincoln dryland environment.

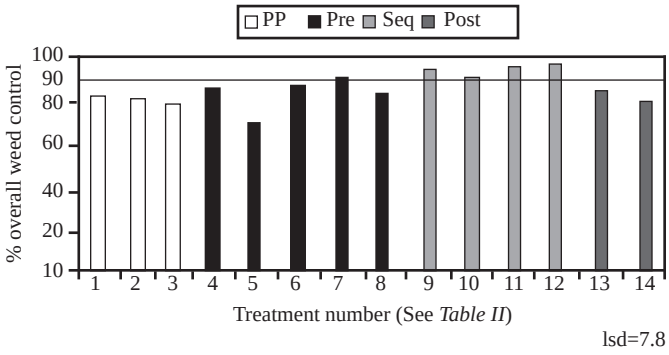


Figure 1. Overall weed control in no-till corn with individual herbicide treatments grouped by application strategy.

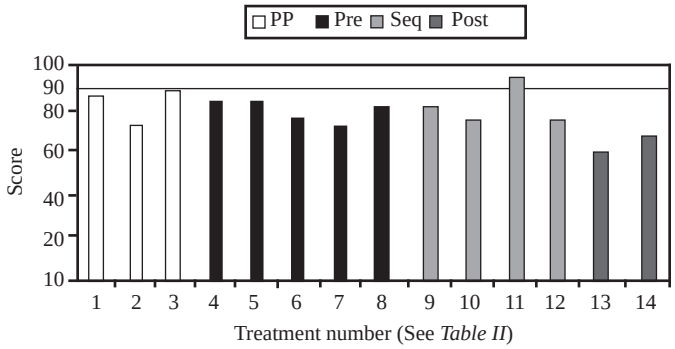


Figure 2. Corn response scores for individual herbicide treatments in no-till corn based on corn injury, height, and yield.

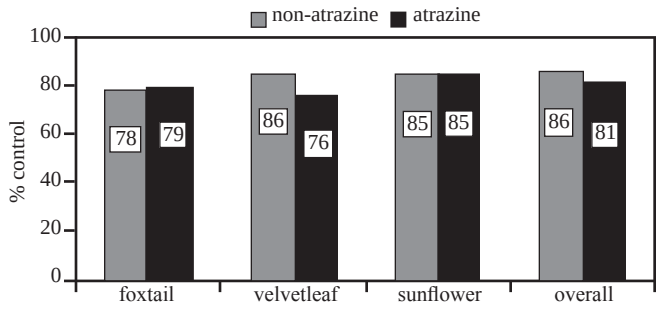
Table I. Dates and plant stages for application events 1999-2000.

Nebraska location	*Year*	*Event*[1]	*Date*	*Crop height (inch)-stage*	*Moisture rec'd after event + 10 days (inch)*	*Weed heights (inch)*		
						Velvetleaf	*Foxtail*	*Sunflower*
Clay Center (CC)	1999	Preplant	April 19	0-0	0.4	0.25	0.25	not present
		Pre	May 8	0-0	2.1	0.3	0.25	
		Epost	May 25	2-V1.5	2.2	1.0	1.0	
		Mpost	June 11	12-V3.5	0.8	4.0	4.0	
		Lpost	June 17	15-V4.5	3.4	6.0	5.5	
	2000	Preplant	April 17	0-0	0.2	0	0	not present
		Pre	April 25	0-0	1.2	0	0	
		Epost	May 9	1-V1	0.2	0.5	0.5	
		Mpost	June 1	10-V4	2.8	8.0	3.0	
		Lpost	June 12	23	1.4	11.5	8.0	
Lincoln (LN)	1999	Preplant	May 9	0-0	2.9	0.25	0.5	2.0
		Pre	May 19	0-0	1.2	3.0	3.0	3.0
		Epost	June 10	5-V3	0.4	6.0	5.5	12.0
		Mpost	June 18	10-V5	3.2	4.0	3.0	5.0
		Lpost	June 25	16-V7	4.6	6.0	4.0	8.0
	2000	Preplant	May 10	0-0	0	1.5	2.5	4.5
		Pre	May 16	0-0	1.3	3.0	3.5	5.5
		Epost	June 1	3-V2	0	1.0	2.0	3.0
		Mpost	June 12	13-V5	2.0	1.5	1.5	13.5
		Lpost	June 27	13-V5	0.2	4.5	3.5	10.5

[1]Pre=Preemergence, Epost=Early postemergence, Mpost=Medium postemergence; Lpost=Late postemergence.

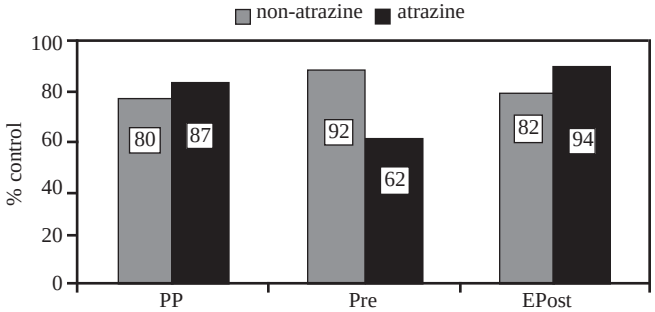
The four non-atrazine and four atrazine treatments selected for direct comparison *(Table II)* were equally effective in overall weed control, foxtail control, and sunflower control averaged across application strategies *(Figure 3)*. They did differ in velvetleaf control because Balance herbicide was especially effective on velvetleaf. When application time is considered, the atrazine treatments were more effective for velvetleaf control in early preplant and early postemergence treatments, but were less effective in preemergence treatments *(Figure 4)*. The main difference in foxtail control was in the early postemergence treatment *(Figure 5)*. For sunflower, atrazine was helpful at EPP but was less effective postemergence *(Figure 6)*. Overall weed control was superior in the preemergence, non-atrazine treatments *(Figure 7)*. Corn yields were similar between atrazine and non-atrazine treatments except the non-atrazine preemergence treatments yielded slightly better *(Figure 8)*, probably because of better velvetleaf and foxtail control. All treatments yielded better than the weedy check which averaged 28 percent yield loss.

The sequential applications provided better overall weed control than the single applications *(Figure 1)*. In Treatment 12, Roundup Ultra was applied preemergence and postemergence so no residual herbicide was used. As a group, only the sequential treatments controlled each weed species at a high level (>90 percent) (data not shown). Individually, Roundup Ultra + Balance + Axiom preemergence and the postemergence treatment of Roundup Ultra followed by Roundup Ultra also were very good. Atrazine treatments cost less than other treatments in that category.



(Refer to *Table II* for herbicides included in these two groups.)

Figure 3. Percent weed control with four atrazine and four non-atrazine herbicide treatments in no-till corn.



(Refer to *Table II* for herbicides included in these two groups.)

Figure 4. Percent velvetleaf control in no-till corn with atrazine and non-atrazine treatments applied preplant, preemergence, or early postemergence.

Table II. Herbicides used in no-till corn.

Treatment number	*Herbicide treatment*[1]	*Product rate per acre*	*Application time* [1]	*Atrazine group* [2]	*Application strategy* [2]	*Treatment cost per acre* [3]
1	Axiom 68 WDG + Balance 75 WDG + COC	8.0 oz/A + 2.0 oz/A + 1.0 qt/a	PP PP PP	—	PP	$34.55
2	Epic + Atrazine 90DF + COC	11.0 oz/A + 1.11 lb/A + 1.0 qt/A	PP PP PP	A	PP	$32.24
3	Epic 58 WG + COC	15.0 oz/A + 1.0 qt/A	PP PP	N	PP	$38.06
4	FieldMaster + AMS	4.0 qt/A + 2.5 lb/A	Pre Pre	A	Pre	$30.06
5	Fultime + Roundup Ultra + AMS	3.0 qt/A + 1.0 qt/A + 3.4 lb/A	Pre Pre Pre	A	Pre	$36.24
6	Balance 75WDG + TopNotch + Roundup Ultra + AMS	2.0 oz/A + 1.25 qt/A + 1.5 pt/A + 2.5 lb/A	Pre Pre Pre Pre	N	Pre	$43.07
7	Balance 75WDG + Axiom 68 WDG + Roundup Ultra + AMS	2.0 oz/A + 12.0 oz/A + 1.5 pt/A + 2.5 lb/A	Pre Pre Pre Pre	N	Pre	$45.89
8	Balance 75 WDG + Hornet 85.6 WG + Roundup Ultra + AMS	2.0 oz/A + 2.4 oz/A + 1.5 pt/A + 2.5 lb/A	Pre Pre Pre Pre	—	Pre	$41.85
9	Epic 58 WG Roundup Ultra + AMS	15.0 oz/A 2.0 pt/A + 3.4 lb/A	PP Epost Epost	—	Seq	$60.43
10	Epic 58 WG Roundup Ultra + AMS	12.0 oz/A 2.0 pt/A + 3.4 lb/A	Pre Epost Epost	—	Seq	$53.63
11	Roundup Ultra + AMS Roundup Ultra + AMS	2.0 pt/A + 3.4 lb/A 2.0 pt/A + 3.4 lb/A	Pre Pre Mpost Mpost	—	Seq	$38.86
12	Roundup Ultra + AMS Roundup Ultra + AMS	2.0 pt/A + 3.4 lb/A 2.0 pt/A + 3.4 lb/A	Epost Epost Lpost Lpost	—	Seq	$38.86
13	Lightning + Atrazine + MSO + UAN	1.28 oz/A + 1.0 lb/A + 1% V/V + 1.5 qt/A	Epost Epost Epost Epost	A	Post	$37.24
14	Lightning + Clarity + NIS + UAN	1.28 oz/A + 6.0 oz/A + 0.25% V/V + 1.5 qt/A	Epost Epost Epost Epost	N	Post	$35.09

[1]Abbreviations: AMS=ammonium sulfate, COC=crop oil concenterate, MSO=methylated seed oil, NIS=nonionic surfactant, PP=Preplant, Pre=Preemergence, Epost=Early postemergence, Mpost=Medium postemergence, Lpost=Late postemergence.
[2]A=atrazine treatment; N=non-atrazine treatment; Seq=Sequential (EPP or Pre followed by Post); Post=postemergence.
[3]Cost of herbicides, additives, and application plus seed technology fee. Roundup Ready technology fee ($8.00/A) applied to Treatments 9-12 and Clearfield technology fee ($6.50/A) to Treatments 13-14. Application cost figured at $5.00/A per application time.

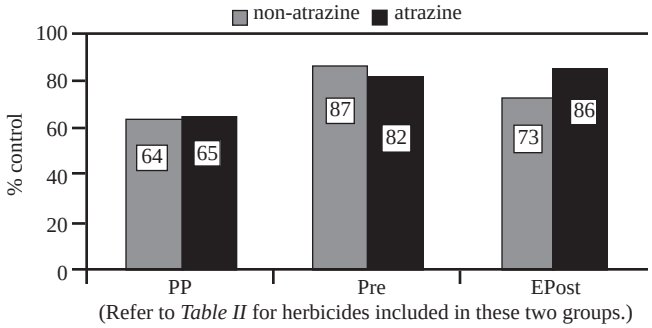


Figure 5. Percent foxtail control in no-till corn with atrazine and non-atrazine treatments applied preplant, preemergence, or early postemergence.

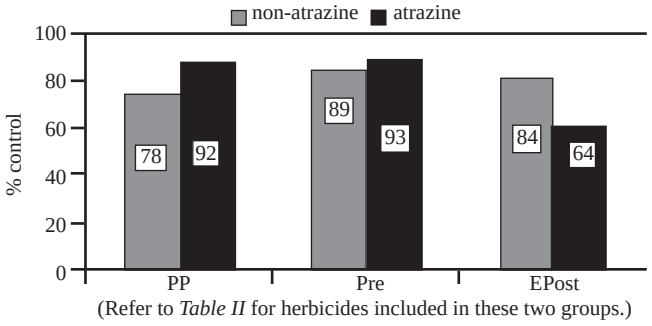


Figure 6. Percent sunflower control in no-till corn at Lincoln with atrazine and non-atrazine treatments applied preplant, preemergence, or early postemergence.

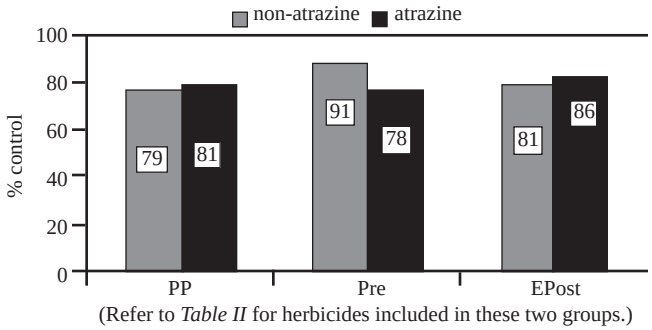


Figure 7. Percent overall weed control in no-till corn with atrazine and non-atrazine treatments applied preplant, preemergence, or early postemergence.

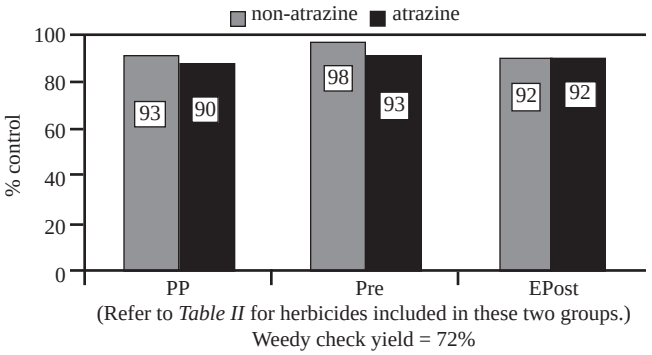


Figure 8. No-till corn yields as a percentage of the handweeded treatments at Clay Center and Lincoln in 1999, comparing atrazine and non-atrazine treatment combinations.

Procedure

Experimental procedures were similar at both locations. The no-till corn followed soybean. A Roundup Ready hybrid was used for Treatments 1-12 and an imidazolinone-tolerant (Clearfield) hybrid was used for Lightning Treatments 13 and 14. Important dates are given in *Table I*. Experimental plot size was four, 30-inch rows wide by 33 feet long at Clay Center and six, 30-inch rows by 33 feet at Lincoln. All treatments were replicated three times at each site. Herbicides were applied in water at 20 GPA using 11002 spray tips on small-plot, tractor-mounted sprayers operated at 30 PSI and 2.5 mph. Additives were appropriate for each herbicide and timing. Postemergence treatments were applied topically to weeds and crop.

Crop response and weed control were evaluated in early July and at harvest. Corn yields are reported for 1999 only. Dry weather at Lincoln and corn greensnap at Clay Center in 2000 rendered yield comparisons meaningless. Data were analyzed three ways: individual herbicide treatment comparisons, atrazine and non-atrazine treatment comparison, and treatment timing comparison– preplant, preemergence, sequential (preplant or preemergence followed by postemergence application), and postemergence. *Table I* lists the groupings and individual treatment costs based on November 2000 prices.

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Elbert C. Dickey, Dean and Director of Cooperative Extension, University of Nebraska, Institute of Agriculture and Natural Resources.